

STEREO MOC Status Report
Time Period: 2015:194 - 2015:200

STEREO Ahead (STA) Status:

1. The following Ground System anomalies/events occurred during this reporting period:

- On day 194, during the DSS-63 support, while the first 30 minutes RF communications were quite good, then the signal degraded significantly & continuously for the remainder of the support resulting in the disabling of the SSR playback to minimize data loss. A second downlink receiver was placed on-line, however, it showed the same behavior. Only 52% of expected telemetry frames were received. See DR# M108891 for more information.
- On day 194, during the DSS-14 support, RF communications were quite good with only occasional dropouts due to solar interference with a command success rate of 98% and 52 missing telemetry frames resulting in over 99% of the expected telemetry frames received.
- On day 195, during the DSS-14 support, RF communications were quite good with only occasional dropouts due to solar interference with a command success rate of 98% and 40 missing telemetry frames resulting in over 99% of the expected telemetry frames received.
- On day 196, during the DSS-14 support, RF communications were quite good with only occasional dropouts due to solar interference with a command success rate of 100%. At 1726z, a DCD failover at the DSN contributed to the 6 missing telemetry frames resulting in over 99% of the expected telemetry frames received. See DR# G116425 for more information.
- On day 196, during the DSS-43 support, RF communications were quite good with only occasional dropouts due to solar interference with a command success rate of 100% and 20 missing telemetry frames resulting in over 99% of the expected telemetry frames received.
- On day 197, during the DSS-14 support, RF communications were quite good with only occasional dropouts due to solar

interference with a command success rate of 100% and 3 missing telemetry frames resulting in over 99% of the expected telemetry frames received.

- On day 198, during the DSS-63 support, RF communications were quite good with only occasional dropouts due to solar interference with 1 dropped command resulting in a command success rate of 97% and 16 missing telemetry frames resulting in over 99% of the expected telemetry frames received.
 - On day 199, during the DSS-43 support, turbo decoder lock was lost briefly at 0214z due to the effects of solar scintillation. This anomaly resulted in the loss of one frame of spacecraft SSR playback.
 - On day 199, during the DSS-63 support, turbo decoder lock was lost briefly at 1412z due to the effects of solar scintillation. This anomaly resulted in the loss of one frame of real-time data.
 - On day 199, during the DSS-43 support, turbo decoder lock was lost briefly at 200-0046z due to the effects of solar scintillation. This anomaly resulted in the loss of 2 frames of spacecraft SSR playback and real-time data.
 - On day 200, during the DSS-63 support, turbo decoder lock was lost intermittently between 1036z and 1739z due to the effects of solar scintillation. This anomaly resulted in the loss of 13 frames of spacecraft SSR playback and real-time data.
2. The following spacecraft/instrument events occurred during this week. The Ahead observatory has successfully exited the 3 month long solar conjunction and all instruments are once again returning science for side lobe operations. The successful superior solar conjunction exit and return to science was highlighted in the NASA image of the day (<http://www.nasa.gov/image-feature/stereo-a-spacecraft-returns-data-from-the-far-side-of-the-sun>) displaying a recent SECCHI EUVI image. The Ahead observatory is operating nominally on the 2nd side lobe of the HGA to prevent overheating of the HGA feed assembly which is currently at 111 degrees C and decreasing with the HGA angle at 8.6 degrees and increasing, with respect to the spacecraft-Sun line.

- On day 194, July 13th, during the track with DSS-14, the STEREO AHEAD observatory continued to operate nominally, 3-axis stabilized while communicating on the 2nd HGA side lobe. The HGA feed temperature remained within the predicted range at 112 degrees C. System momentum was at 7.9 Nms and increasing.

Instruments Returned to Science:

SWAVES - Continues to collect science. Was on and recording throughout solar conjunction, except for the 12 day period during the SLVS anomalies, May 14th through 26th (days 134-2239z through days 146-2305z).

IMPACT MAG - Returned to science data collection on July 9th.

IMPACT SEPT - Returned to science data collection on July 9th.

SECCHI - Returned to science data collection on July 11th at 192-1955z.

IMPACT HET - Returned to science data collection on July 13th.

IMPACT Status (from Glenn Mason and Kristin Wortman):

As of the end of the track today, HET is producing science. Due to solar interference, efforts to patch LET have been slowed. SWEA and STE will remain powered off until we return to the main lobe. The SIT-A high voltage ramp-up was completed today, and the analog HK values from the instrument are at nominal levels. The largest of the lookup SIT tables has not been successfully reloaded. A problem we had on Friday went away when Kristin switched back to the old GSE, so something in the new setup is causing the large "box" table to be rejected. The smaller SIT tables were loaded from the new GSE on Friday. Using the old GSE there were 2 attempts to load the box table today, and both failed before completing the task. The box table is used in the on-board classification scheme. Judging from the HK table checksum the tables are in some intermediate state, which puzzles us since we had believed that SIT gets the tables from the DPU only when they are complete. There are no particle intensities showing up on the beacon data web page, which could be due to the state of the tables, or might indicate some other problem. When we get today's data tomorrow we can check this out; with the housekeeping we have only very limited information.

PLASTIC Status (from David Heirtzler):

Continued increasing high voltages on the PAC from 10 kV to 15 kV. The MCP voltages were stepped up from 1600 V, to 1800 V, and finally to 2400 V.

SSR partitions percent full status:

IMPACT space weather = 54.2
PLASTIC space weather = 51.0
SWAVES space weather = 52.6

S/C C&DH and G&C Housekeeping SSR Data Return:

As analysis of the event and anomaly SSR data indicates that the SLVS anomalies began on day 134, the S/C housekeeping SSR read pointers were repositioned to day 133 to begin playing back anomaly data of interest. There are approximately 12 days of interest and all the G&C housekeeping data has been received. However, as the C&DH record rates are increased to 1 Hz for approximately 24 hours as part of the SLVS response, the C&DH downlink has been slowed. Data downlink today included:

C&DH housekeeping = Days 135 through 135-0614z
G&C housekeeping = Days 151 through 157-1923z

- On Tuesday, July 14th, during the track with DSS-14, the STEREO AHEAD observatory continued to operate nominally, 3-axis stabilized while communicating on the 2nd HGA side lobe. The HGA feed temperature remained within the predicted range at 112 degrees C. System momentum is at 8.3 Nms and increasing.

Instruments Returned to Science:

SWAVES - Continues to collect science. Was on and recording throughout solar conjunction, except for the 12 day period during the SLVS anomalies, May 14th through 26th (days 134-2239z through days 146-2305z).

IMPACT MAG - Returned to science data collection on July 9th.

IMPACT SEPT - Returned to science data collection on July 9th.

SECCHI - Returned to science data collection on July 11th at 192-1955z.

IMPACT HET - Returned to science data collection on July 13th.

IMPACT Status (from Glenn Mason and Kristin Wortman):

As of the end of the track today, the Magnetometer, SEP, HET are producing science. SWEA and STE will remain powered off until the HGA returns to the main lobe. Due to solar interference, efforts to patch LET have been slowed. Regular science data from SIT-A from July 13 after the HV was ramped up showed that the instrument MCPs were triggering normally, and events were being analyzed. However, the on-board rate computation was returning 0 counts in all boxes, due to the dropouts in the table loads experienced on July 13. Kristin made another attempt to load the matrix box table and it also had dropouts and so was unsuccessful. We discussed the large number of problems experienced with commanding both SIT and LET, where many fairly sort commands do not make it successfully. Given this background we decided that loading the large SIT tables at this time would probably be fruitless. It was decided to reboot SIT-A, since this loads the original table set from SEP central. That table set is obsolete and is not optimally calibrated, but it does return approximately calibrated data which we consider an improvement over no data at all. After the reboot, SIT-A HV was ramped up again, with the last step taken just before the end of the pass (and therefore not observed at the MOC since the latency is about 45 min). Up until that point everything monitored was nominal, and as expected some intensity counts began appearing on the STEREO beacon page SIT-A plot. We will be able to examine the response to the last command step using science data on Wednesday. Our plan is to upload the up-to-date table set when the STEREO commanding link is more robust, perhaps on August 1st, when the SPE angle is at 3.0 degrees.

PLASTIC Status (from David Heirtzler):

- 1.) MCPs brought up to 2590V which was our original operating voltage at the beginning of the mission.
- 2.) The PAC was brought to -18kV and then monitored for stability.
- 3.) After a while the PAC was brought to -20kV which is the full mission operating value.
- 4.) The instrument was put into mode 3 to collect monitor rates.

SSR partitions percent full status:

IMPACT space weather = 54.5
PLASTIC space weather = 51.3
SWAVES space weather = 52.8

S/C C&DH and G&C Housekeeping SSR Data Return:

C&DH housekeeping = Days 135 through 135-0853z
G&C housekeeping = Days 157 through 164-1249z

Known Issues:

1. G&C reaction wheel #3, currently disabled by MOPs, not responding to torque commands. Data analysis has determined that the wheel internal overspeed protection was tripped during a slew back to the Sun during the 2nd SLVS anomaly. A procedure to power cycle the wheel is being developed and tested.
 2. Four soft low voltage shutdowns (SLVS) anomalies occurred during solar conjunction, centered about 0 degrees SPE. Analysis of the data received indicates that the observatory responded as designed. The root cause is resetting the observatory while the Earth and Sun vectors are closely aligned. Fault protection recovered the observatory each time. As the SLVS response will power down all instruments, SWAVES data will have a gap starting on day 134 for 12 days.
- On Wednesday, July 15th, during the tracks with DSS-14 and 43, the STEREO AHEAD observatory continued to operate nominally, 3-axis stabilized while communicating on the 2nd HGA side lobe. The HGA feed temperature remained within the predicted range at 112 degrees C. System momentum is at 8.7 Nms and increasing.

Instruments Returned to Science:

SWAVES - Continues to collect science. SWAVES was on and recording throughout solar conjunction, except for the 12 day period during the SLVS anomalies, May 14th through 26th (days 134-2239z through days 146-2305z).
IMPACT MAG - Returned to science data collection on July 9th.
IMPACT SEPT - Returned to science data collection on July 9th.

SECCHI - Returned to science data collection on July 11th at 192-1955z.

IMPACT HET - Returned to science data collection on July 13th.

IMPACT SIT - Returned to science data collection on July 14th.

IMPACT LET - Returned to science data collection on July 15th.

IMPACT Status (from Andrew Davis, Glenn Mason, and Kristin Wortman):

As of the end of today's tracks, the Magnetometer, SEPT, HET, SIT, and LET are producing science. SWEA and STE will remain powered off until the HGA returns to the main lobe. We successfully uploaded and verified the final patch for LET Ahead. LET Ahead is now fully operational and collecting science data.

At this morning's pass Kristin confirmed that SIT-A is at its operating HV level and you can see that some counts are appearing on the Beacon web page, although activity is very low right now. The rate lookup table boxes from the pre-launch set have calibration problems:

- 1) He intensities are about a factor of 5 low
- 2) H, O, and Fe intensities are approximately correct (within a factor of 2)

If we had PHA data these intensities could be correctly calculated on the ground; however, since all the PHA data is being suppressed that will not be possible. In any case the Beacon data would have the calibration problem, but I think that this is nevertheless much better than zero output from the intensities. Since the daily coverage is so sparse, I believe the actual science loss is very small at this point. We are not requesting any change in the suppression of PHA data.

We do not want to attempt table loads until we have good assurance that they will succeed. This is because a failed attempt clears the existing tables and leaves us with nothing. To restore the original tables requires a reboot and then we need to bring up the HV, and that is not risk free.

Kristin and I will be in touch with Dan Ossing the week of Aug 3 to assess the situation. Dan expects the link to be much improved then. We are hoping that maybe some other experiments will have been doing some significant commanding loads so that there is data to gauge the chances of the SIT loads going through. If it is dubious, we will wait some more. We never had table upload problems in the past, so this is just a matter of waiting for the communications to get back closer to normal.

I am very pleased that SIT-A has survived the hibernation apparently without degradation, and feel sure that the table upload issue will be solved in the next month or so. I'd like to thank Kristin and the flight ops team for all the excellent support.

PLASTIC Status (from David Heirtzler):

Today we tweaked the high resolution rates so we could better make a determination of what changes are needed to our tables and what voltage we should put on our MCPs.

SSR partitions percent full status:

IMPACT space weather = 54.8
PLASTIC space weather = 51.5
SWAVES space weather = 53.0

S/C C&DH and G&C Housekeeping SSR Data Return:

C&DH housekeeping = Days 135 through 135-1121z
G&C housekeeping = Days 164 through 170-1828z

Known Issues Status:

1. G&C reaction wheel #3, currently disabled by MOPs, not responding to torque commands. Data analysis has determined that the wheel internal overspeed protection was tripped during a slew back to the Sun during the 2nd SLVS anomaly. A procedure to power cycle the wheel has been reviewed with the manufacturer and GSFC management and is scheduled for powering cycling on Thursday at 1645z. Note that fine pointing may be intermittent for a few minutes as momentum is re-distributed amongst the wheels.
2. The four soft low voltage shutdowns (SLVS) anomalies that occurred during solar conjunction were centered about 0

degrees SPE. Analysis of the data received indicates that the observatory responded as designed, however, it was not designed for being out of contact for 3 months. The root cause is resetting the observatory while the Earth and Sun vectors are closely aligned. Fault protection recovered the observatory each time. As the SLVS response will power down all instruments, SWAVES data will have a gap starting on day 134 for 12 days.

- On Thursday, July 16th, during the track with DSS-14, the STEREO AHEAD observatory continued to operate nominally, 3-axis stabilized while communicating on the 2nd HGA side lobe. G&C was returned to normal operations today when wheel #3 was power cycled and resumed responding to G&C torque commands. The HGA feed temperature remained within the predicted range at 112 degrees C. System momentum is at 9.1 Nms and increasing.

Instruments Returned to Science:

SWAVES - Continues to collect science. SWAVES was on and recording throughout solar conjunction, except for the 12 day period during the SLVS anomalies, May 14th through 26th (days 134-2239z through 146-2305z).

IMPACT MAG - Returned to science data collection on July 9th.

IMPACT SEPT - Returned to science data collection on July 9th.

SECCHI - Returned to science data collection on July 11th at 192-1955z.

IMPACT HET - Returned to science data collection on July 13th.

IMPACT SIT - Returned to science data collection on July 14th.

IMPACT LET - Returned to science data collection on July 15th.

IMPACT Status:

SIT will load calibration tables when the observatory clears the region of solar interference, approximately 3.0 degrees for the 2nd side lobe communications, on or about August 3rd. SWEA and STE will remain powered off, due to very limited telemetry bandwidth during side lobe operations, until the HGA returns to the main lobe.

PLASTIC Status (from David Heirtzler):

Today we were able to determine that our MCP voltage needed to be raised, so we brought it up to 2950V. The operating value before solar conjunction was 3125V. The thinking we had was that with the new side of the MCP now being exposed we would not need so much bias to get the desired response.

We also setup all of our S-channel switching, got all of our table loads in, and implemented limit checking and safing.

The plan is to collect data in our science mode over the weekend and turn on our deflectors on Monday. That should have us in our nominal science mode. The reason we've been putting off the deflector and entrance system turn on until now is that we had an issue with a high current just before we went into conjunction and we want to make sure all of our safeties are in place before we do so.

SSR partitions percent full status:

IMPACT space weather = 55.0
PLASTIC space weather = 51.7
SWAVES space weather = 53.2

S/C C&DH and G&C Housekeeping SSR Data Return:

C&DH housekeeping = Days 135 through 135-1403z
G&C housekeeping = Days 170 through 177-1445z

Known Issues: All closed. Summary of issues from solar conjunction are below.

1. G&C reaction wheel #3 not responding to torque commands. Data analysis determined that the wheel internal overspeed protection was tripped during a slew back to the Sun during the 2nd SLVS anomaly. Wheel #3 was power cycled today at 1645z and again began responding nominally to G&C torque commands. Fine pointing was lost intermittently as momentum was re-distributed amongst the four wheels.
2. The four soft low voltage shutdowns (SLVS) anomalies that occurred during solar conjunction were centered about 0 degrees SPE. Analysis of the data received indicates that the observatory responded as designed, however, it

was not designed for being out of contact for 3 months. The root cause is resetting the observatory while the Earth and Sun vectors are closely aligned. Fault protection recovered the observatory each time. As the SLVS response will power down all instruments, SWAVES data will have a gap starting on day 134 for 12 days.

STEREO Behind (STB) Status:

1. The following Ground System anomalies/events occurred during this reporting period:

- None.

2. Detailed status of the activities that occurred on the Behind loss of communication anomaly, which occurred on day 2014-274, are listed below.

- The Behind observatory entered superior solar conjunction at the 2.0 degree SPE angle on day 022. Recovery efforts resumed post solar conjunction on day 124, May 4th through day 178, June 27th, as the spacecraft had cleared solar interference for LGA communications. The Failure Review Board recommendations were implemented consisting of battery state of charge recovery and powering on the downlink carrier. The Green Bank Radio Telescope and the Arecibo Observatory also observed the carrier recovery tracks. To date, no downlink signal has been detected from the Behind observatory. Due to Behind's retrograde motion causing it to re-enter the region of solar interference, recovery operations will be suspended from July through November. The Failure Review Board's recommended faster frequency segmented acquisition sequence will be tested with the Ahead observatory in September. The DSN uplink arraying capability will be tested again with the Ahead observatory in October and November, and when it is ready, it will be used to increase the spacecraft received signal power to assist with Behind recovery commanding. With time the spacecraft range improves RF communications and the ability for other assets to acquire data on Behind. LGA uplink margin returns to 6 dB for the 7.8 bps rate in March 2016 and 125 bps in December 2019 and the LGA downlink margin returns to 3 dB for the 12 bps rate in December 2016 and 35 bps in March 2018.

Significant findings to date:

1. Analysis of the three DSN extracted telemetry frames from the carrier signal just before the planned observatory reset/anomaly occurred on day 2014-274, October 1st, showed nominal performance of the spacecraft, i.e., no anomalies, IMU off, and the star tracker providing an attitude solution.
2. Post reset, from the very limited telemetry, three packets, extracted from the carrier signal by the DSN, the X-axis gyro on IMU-A had failed. Unfortunately, this telemetry contained only G&C anomaly data and no spacecraft summary data, i.e., the state of the RF, G&C, fault protection and other subsystems is not known at the time of the anomaly. With a failed IMU and the star tracker being off-line for an undetermined duration, the sun sensors will keep the observatory pointed at the Sun, though the G&C will not have any roll knowledge, and cannot roll the observatory as part of the safing configuration to re-establish communications on the LGAs. From analysis of this telemetry and initial G&C simulations, it is highly suspected that the observatory is rotating about the principal axis of inertia due to an autonomous momentum dump initiated by biased gyro data flagged good by the IMU, but this has not yet been confirmed.
3. At least two anomalies occurred post reset, the star tracker not promoting to AAD mode and the X-axis gyro failure. Unfortunately, due to the number of possible combinations, the STEREO fault protection system is not designed for simultaneous failures.

Once communications are restored and the anomaly resolved, the Behind observatory will be returned to nominal science data collection as soon as it is safely possible.